

APPENDIX B

TECHNICAL MEMORANDUM SUPPLEMENTAL EAST DIKE AREA AND PIT B SITE INVESTIGATIONS BAILEY SUPERFUND SITE ORANGE COUNTY, TEXAS

801461

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**TECHNICAL MEMORANDUM
SUPPLEMENTAL EAST DIKE AREA AND
PIT B SITE INVESTIGATIONS**

**BAILEY SUPERFUND SITE
ORANGE COUNTY, TEXAS**

Prepared by



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EXECUTIVE SUMMARY

This document has been prepared by GeoSyntec Consultants (GeoSyntec), Atlanta, Georgia, for the Bailey Site Settlers Committee (BSSC) to present the results of the supplemental site investigations performed in the East Dike Area and Pit B of the Bailey Superfund Site, located in Orange County, Texas. This work product is the result of *"Addendum 1 of Sampling and Analysis Plan for Supplemental Site Investigation for Focused Feasibility Study, Revision 1"* (SAP-AD1). GeoSyntec submitted the SAP-AD1 to the U.S. Environmental Protection Agency, Region 6 (USEPA) on 27 October 1995.

East Dike Area

The East Dike Area supplemental site investigation was performed to better define the composition and nature of the waste in this area. Previous investigations and studies in the East Dike Area did not sufficiently characterize the waste (i.e., in terms of waste component types, particle size, heterogeneity, and presence of solidification inhibitors) for an evaluation of the technical feasibility of using in-situ solidification technologies.

The field work consisted of excavating seven test pits in the East Dike Area. The excavation of each test pit was carefully logged and documented to provide an estimation of the gross composition of the waste. Bulk waste samples were obtained at several depths from six of the test pits. The bulk waste samples were hand sorted and sieved to estimate the composition and particle size distribution of the smaller waste fractions.

The laboratory program for this SAP-AD1 involved testing selected waste samples for loss on ignition to estimate the percentage of organic material in the waste. Soil samples collected from beneath the waste were also tested to evaluate certain physical properties that will be used in the evaluation of alternative remedies for the Bailey Superfund Site, and for the development of an alternative design.

Based on the results of the field investigations and laboratory testing program, GeoSyntec concludes that a variety of municipal and industrial wastes were co-disposed in the northern portion of the East Dike Area. These wastes include a high proportion of decomposed municipal solid waste, rubber crumb, and debris (metal, glass, and wood), and have a high organic content (up to 60.5 percent as determined by loss on ignition). This conclusion is significant since USEPA and industry recognize significant difficulties and limitations in solidifying municipal waste, wastes containing a high proportion of debris, and wastes that have a high organic content (greater than one percent total organic content).

The waste in the middle portion of the East Dike Area is comprised of rubber crumb and other rubbery wastes that also have a high organic content (loss on ignition up to 89.3 percent). This waste material was often observed as being a relatively hard mass that was more difficult to excavate than a typical uncemented soil material. In attempts to excavate this material, the backhoe tended to excavate sheet- or block-like pieces of the waste by tearing it from the hard waste mass. The southern portion of the investigated area contains rubber crumb and rubbery wastes that are not as hard as the middle portion of the investigated area.

GeoSyntec has previously reviewed and cited several documents that establish USEPA's position with respect to the solidification of problematic wastes in the *"Technical Memorandum, Supplemental North Dike Area Site Investigation and Evaluation of Original Remedy, Bailey Superfund Site, Orange County, Texas."*

Based on the USEPA documents, the additional data obtained during the supplemental site investigation, GeoSyntec's evaluation of the in-situ solidification component of the original design, and the findings presented in this report, it is concluded that successful in-situ solidification of the northern and middle portions of the East Dike Area to the specified performance criteria is technically infeasible, given the composition of the waste. In addition, according to the Record of Decision (ROD) for the Bailey Superfund Site, the functions of solidification are to *"reduce the mobility of the wastes and provide strength to support the cap."* Based on the results presented in this report, the wastes in the East Dike Area have adequate strength to support a final cover system and solidification for this purpose is not needed.

Pit B

Following a review of the existing data for the Pit B waste, GeoSyntec concluded that there were not sufficient data to adequately evaluate alternative disposal options for the Pit B waste. Therefore, a supplemental site investigation of Pit B was implemented to collect and analyze samples of the waste.

Based on a statistical evaluation of the analytical data for the Pit B waste samples, benzene is present at hazardous levels in the eastern portion of Pit B when compared to TCLP regulatory levels, as prescribed in 40 CFR §261.24. In addition, benzene in sample G-TP-W-1 was detected at a concentration greater than the universal treatment standard (UTS) for benzene as set in 40 CFR §268.48.

Based on the results of the supplemental site investigation, GeoSyntec recommends that Pit B be considered an isolated "hot spot", consistent with the definition presented in "Presumptive Remedy for CERCLA Municipal Landfill Sites." However, additional investigations are necessary to accurately evaluate the lateral and vertical limits of Pit B and to estimate the volume of waste and affected sediments that exhibit hazardous characteristics.

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1. INTRODUCTION

1.1 Terms of Reference

This document has been prepared by GeoSyntec Consultants, Atlanta, Georgia (GeoSyntec) for the Bailey Site Settlers Committee (BSSC) to present the results of the supplemental site investigation activities performed in the East Dike Area and Pit B of the Bailey Superfund Site, located in Orange County, Texas. This work product is the result of "*Addendum 1 of Sampling and Analysis Plan for Supplemental Site Investigation for Focused Feasibility Study, Revision 1*" [GeoSyntec, 1995a] (SAP-AD1). GeoSyntec submitted the SAP-AD1 to the U.S. Environmental Protection Agency, Region 6 (USEPA) on 27 October 1995.

The supplemental site investigations described in this report were not specifically addressed in the original "*Work Plan for Focused Feasibility Study, Revision 1*" [GeoSyntec, 1995b] (Work Plan), but they were performed to fill data gaps identified following a review of the available data relative to the site. GeoSyntec conducted a detailed review of existing site data as part of Task 3, Review of Site Data, of the Work Plan.

The work described in this report was performed as outlined in the approved SAP-AD1, and in accordance with the specific requirements of the following documents:

- *Sampling and Analysis Plan for Supplemental Site Investigation for Focused Feasibility Study, Revision 1*, [GeoSyntec, 1995c] (SAPSSI) ;
- *Quality Assurance Project Plan* [Harding Lawson Associates (HLA), 1991a] (QAPP), as amended by Appendix A of the SAPSSI;
- *Final Sampling and Analysis Plan* [HLA, 1991b] (SAP-HLA);
- *Health and Safety Plan* [Parsons Engineering Science, Inc. (Parsons ES), 1995] (HASP), and Addenda Number 1 and 2; and
- *Health and Safety Plan* [GeoSyntec, 1995d] (GHASP).

1.2 Project Background

The Bailey Superfund Site is located approximately 3 mi (5 km) southwest of Bridge City in Orange County, Texas. The site was originally part of a tidal marsh near the confluence of the Neches River and Sabine Lake. In the early 1950s, Mr. Joe Bailey constructed two ponds (Pond A and Pond B) at the site as part of the Bailey Fish Camp. The ponds were reportedly constructed by dredging the marsh and piling sediments to form dikes along the northern and eastern limits of Pond A (the North Dike Area and the East Dike Area, respectively). Between the time of construction (1950s) and the spring of 1971, Mr. Bailey used a variety of wastes including industrial wastes, municipal solid waste (MSW), and debris as fill material for these dikes.

In 1984, USEPA proposed the site for inclusion on the National Priorities List (NPL). The site was placed on the NPL in 1986. A remedial investigation (RI) [Woodward-Clyde Consultants, 1987] was completed for the site in October 1987, and a feasibility study (FS) [Engineering-Science, Inc., 1988] was completed in April 1988. The RI concluded that: (i) the site has had no impact on drinking water; and (ii) in the unlikely event that site constituents were to migrate via ground-water flow, it would take over 800 years for them to reach potable ground water. The shallow ground water beneath and adjacent to the site is saline and not suitable for human consumption. The closest public water supply well, located approximately 1.5 mi (2.4 km) northeast of the site, is estimated to be approximately 385 ft (117 m) deep. The nearest municipal water supply wells are located approximately 2.6 mi (4.2 km) northeast of the site and have a reported depth of approximately 585 ft (173 m). There has been no development in the immediate vicinity of the Bailey Superfund Site, nor is it likely to be suitable for future development due to prohibitions against development in wetlands areas. No air emissions above ambient conditions were detected during air monitoring activities conducted during RI field activities.

In the FS report, Engineering-Science recommended in-situ solidification of the on-site waste as the preferred remedy for the site. USEPA selected this remedy in the Record of Decision (ROD) for the site, signed on 28 June 1988. The remediation area comprises the North Dike Area, East Dike Area, and the North Marsh Area. The North Dike Area is approximately 3,000 ft (914 m) long by 130 ft (40 m) wide, and

the East Dike Area is approximately 1,200 ft (366 m) long by 220 ft (67 m) wide. Surficial tarry wastes are present in the North Marsh Area which borders the northern side of the North Dike Area. These wastes extend from the edge of the North Dike Area to a distance of up to 150 ft (46 m) into the marsh. The remediation of the North Marsh Area is being addressed separately as an independent removal action that is planned to occur in early 1996.

A remedial design (RD) for the selected remedy was developed by Harding Lawson Associates, Houston, Texas (HLA) and a construction contract for the implementation of the remedial action (RA) was awarded to Chemical Waste Management, Inc. (Chem Waste) in 1992. The RD specified that the on-site waste be solidified to a minimum unconfined compressive strength of 25 psi (172 kPa) and a hydraulic conductivity of not more than 1×10^{-6} cm/s. During initial attempts to solidify waste in the East Dike, Chem Waste encountered difficulties attaining the specified physical and hydraulic performance criteria (i.e., unconfined compressive strength and hydraulic conductivity) for the solidified waste. As a result of these difficulties, the RA was eventually suspended in early 1994. Remedial activities that were completed prior to the cessation of work include the construction of a dike around the East Dike Area of the site, and partial solidification of waste within the southern portion of the East Dike Area.

After Chem Waste stopped work, the BSSC retained independent contractors and consultants to perform a pilot study at one location in the East Dike Area to evaluate the feasibility of in-situ solidification with respect to achieving the specified physical and hydraulic performance criteria. The study indicated that in-situ solidification in general conformance with the specified performance criteria could be achieved at that location. The study concluded, however, that to meet the specified performance criteria, conformance testing needed to be based on wet sampling of uncured material, followed by laboratory curing, rather than coring of material cured in-situ (as had initially been performed in accordance with the construction specifications) [McLaren-Hart and Kiber Environmental Services, Inc., 1995]. Importantly, the study did not address the feasibility of solidification in other areas of the site (i.e., the North Dike Area and the northern portions of the East Dike Area). The data and information collected during the RI, RA, and subsequent investigations indicate that the waste in the

North Dike Area is deeper and more heterogeneous than the waste in the area of the pilot study. These data also indicate that wastes in the North Dike Area and northern portions of the East Dike Area include MSW, debris, rubber crumb, and tarry wastes which, based on both USEPA and industry experience, are difficult and expensive to effectively solidify in-situ.

Based on RA activities at the site to date, the BSSC concluded that successful site-wide solidification of waste at the site to the specified physical and hydraulic performance criteria will be, at a minimum, expensive, time consuming, and difficult to implement. Recognizing this fact, USEPA requested that BSSC further evaluate the feasibility of solidification and perform a focused feasibility study (FFS) to identify whether more expedient and effective remedial actions for the site may be available.

1.3 Objectives of the Supplemental Site Investigations

1.3.1 Scope

The supplemental site investigations at the site were performed to: (i) better define the composition and nature of the waste material in the East Dike Area; and (ii) characterize and profile the waste material in Pit B. The objectives of the supplemental site investigations for the East Dike Area and Pit B are discussed below.

1.3.2 East Dike Area

In August 1995, a supplemental site investigation was performed in the North Dike Area of the site to evaluate the composition and nature of the waste material. In general, the waste contains varying amounts of co-disposed industrial waste (tarry materials and rubber crumb) and MSW (decomposed MSW, glass, wood, and metal). The results and evaluation of this investigation are presented in *Technical Memorandum, Supplemental North Dike Area Site Investigation and Evaluation of Original Remedy, Bailey Superfund Site, Orange County, Texas* [GeoSyntec, October 1995e] (TM-NDA). Following an evaluation of resultant data, previous work at the

site, and USEPA guidance documents, GeoSyntec concluded that implementation of the original design (i.e., in-situ solidification to specified physical and hydraulic performance criteria) is technically infeasible for the North Dike Area due to the widespread presence of co-disposed or problematic wastes. USEPA concurred with this conclusion in a letter dated 31 October 1995.

While evaluating site information presented in the RI, FS, RD, and RA documents, GeoSyntec found references to the presence of co-disposed waste in portions of the East Dike Area that were not solidified by Chem Waste. Summaries of the previous remedial efforts and the in-situ stabilization pilot demonstration for the East Dike Area are presented in Section 2 of the TM-NDA. The area that has been solidified (southern end of the East Dike) contains waste that has been described as "*black cindery waste: saturated soft; some rubbery chunks, no municipal waste noted*" [HLA, 1991c]. In contrast, the middle and northern portions of the East Dike have been described as containing varying amounts of MSW and black cindery waste.

If the waste in the middle and northern portions of the East Dike Area is similar to the North Dike Area waste and contains a significant proportion of tarry materials, rubber crumb, and MSW, effective solidification could prove difficult, and possibly infeasible. Therefore, to proceed with the evaluation of the original design, and to evaluate potential alternative remedies, it was necessary to better define the composition and nature of the waste material in the East Dike Area in a manner consistent with the methods used for the North Dike Area investigation.

The results of the waste composition analysis will be considered in the FFS during the remedial technology and process option screening activities and the detailed analysis of the remedial alternatives.

1.3.3 Pit B

Pit B is located between the North Dike Area and the North Marsh Area in the western portion of the site. The original design required waste material within this area to be capped following in-situ solidification; however, this work has not been

performed. As part of the FFS, alternative remedies for the treatment or disposal of the Pit B waste will be evaluated. However, data regarding the chemical characteristics of the Pit B waste are limited. More specifically, prior to the supplemental site investigation, adequate data did not exist that would allow preliminary waste profile sheets to be completed. Waste profile sheets are required to make decisions regarding the technical and regulatory feasibility of off-site disposal (a potential alternative remedy for the Pit B waste), and to obtain cost quotations for disposal. It was therefore necessary to collect additional data to fully characterize the Pit B waste in order to proceed with the FFS activities. The sampling and analytical program for Pit B was designed to provide data suitable for these purposes.

The results of the investigation will be used to evaluate alternative treatment or disposal options for the Pit B waste. The evaluation will consider both the technical and regulatory feasibility of each alternative disposal option.

1.4 Document Organization

The remainder of the technical memorandum is organized as follows.

- The investigation, sampling, and testing procedures used for these supplemental site investigations are included in Section 2.
- The investigation and testing results for these investigations are provided in Section 3.
- An interpretation of the results is included in Section 4.
- References cited in this technical memorandum are provided in Section 5.

2. INVESTIGATION, SAMPLING AND TESTING PROCEDURES

2.1 East Dike Area

2.1.1 Test Pit Excavation and Sampling Procedures

On Monday, 13 November 1995, seven test pits (designated G-TP14 through G-TP20) were excavated in the northern and middle portions of the East Dike Area (north of the previously solidified material). In accordance with the SAP-AD1, test pit excavation activities began in the northern end of the area and proceeded southward. The test pit locations are shown on Figure 1.

The test pits were excavated with a backhoe and were approximately 3 to 4 ft (0.9 to 1.2 m) wide, 10 ft (3 m) long, and between 6.5 to 10 ft (2 to 3 m) deep. The test pits were excavated to a depth at least 1 ft (0.3 m) below the bottom of the waste.

The excavated soil and waste material were placed on plastic sheeting down wind from the excavation. Samples of the waste material and the soil beneath the waste were collected from the backhoe bucket with a shovel as the excavation proceeded. A total of nine bulk waste samples were placed in 5-gallon (18.5-l) plastic buckets for waste characterization analysis. Duplicate waste samples were collected for the nine samples and were placed in 2-gallon (7.4-l) Zip-Lock plastic bags for laboratory testing. In addition, two soil samples were collected from beneath the waste for laboratory testing. A summary of the samples collected from the East Dike Area during this supplemental site investigation is included in Table 1.

The walls of the test pits were logged by a field engineer standing along the rim of the excavations. No one was permitted to enter the excavations. Field personnel logged the details of the excavation and the composition of the excavated waste. Photographs were taken and a videotape recording was made during the excavation process. Observations made during the test pit excavation activities are discussed in Section 3 of this document.

2.1.2 Field Tests

Nine bulk samples or portions of the bulk samples were characterized in the field to evaluate the waste composition for each sample. The following procedures were used to perform this evaluation:

- the weight and volume of each waste characterization sample were recorded on a pre-printed waste characterization form;
- the sample was sorted by particle size using a series of 14-in. (360-mm) diameter sieves with square openings of 1 in. (25 mm), 0.5 in. (12.7 mm), and 0.25 in. (6.4 mm);
- the material remaining on each sieve and passing the 0.25-in. (6.4 mm) sieve was then sorted according to composition; and
- the weight and volume for each composition type and particle size were recorded on the waste characterization forms.

The results of the field tests are presented in Section 3 of this document.

2.1.3 Laboratory Tests

The nine waste duplicate samples and the two soil samples collected from beneath the waste were shipped to the GeoSyntec Consultants Environmental Laboratory in Atlanta, Georgia, for additional tests. Seven waste samples were selected for laboratory testing based on the location, depth, and appearance of the samples. The samples were tested for the following:

- loss on ignition (ASTM D 2947) to estimate organic content;
- percent passing No. 4 U.S. standard sieve size (modified ASTM D 422); and
- moisture content (ASTM D 2216).

The two soil samples were tested for the following:

- percent passing No. 200 U.S. standard sieve size (ASTM D 1140);
- Atterberg limits (ASTM D 4318);
- soil classification (ASTM D 2487); and
- hydraulic conductivity (ASTM D 5084).

The results of these laboratory analyses are presented in Section 3 of this document.

2.2 Pit B

2.2.1 Sample Collection

On Tuesday, 14 November 1995, waste and underlying soil (where possible) samples were collected from four locations within Pit B. Sampling locations were selected to provide approximate uniform coverage of the waste within Pit B. Sampling commenced from the eastern end of the pit, and progressed towards the west. Figure 1 indicates the sampling locations.

Samples were collected by (i) pushing a 3-in. (76-mm) inside diameter PVC pipe approximately 4 to 7 ft (1.2 to 2.1 m) into the waste with a backhoe bucket; (ii) placing a cap on the pipe; (iii) pulling the pipe from the waste with a strap attached to the backhoe bucket; (iv) removing the sample from the pipe; and (v) placing the waste sample into laboratory prepared containers. In general, approximately 1- to 2-ft (0.3- to 0.6-m) long sections of the PVC pipes filled with waste. Each waste sample was labeled, placed in a plastic bubble pack bag, and stored on ice in an insulated cooler for transportation to the analytical laboratory. The waste samples were shipped under chain-of-custody protocols to an analytical laboratory for chemical analyses. The chemical analyses were performed by EcoSys Laboratory Services, Norcross, Georgia.

The underlying soil samples were shipped to the GeoSyntec Consultants Environmental Laboratory, Atlanta, Georgia. No testing has been performed on the underlying soil samples, but laboratory tests may be performed during the preparation of the FFS.

2.2.2 Sample Identification

Each sample was given a unique identification number that designated the following:

- sampling organization - GeoSyntec (G)
- general area of the site - test pit (TP) or Pit B (PB)
- sample matrix - waste (W) or soil/sediment (S); and
- location/numerical designation - where duplicates were collected, samples were labeled with an extension of "DUP".

For example, a sample with an identification code of G-PB-W-3 would indicate a waste sample collected by GeoSyntec in Pit B at location 3.

2.2.3 Sample Analysis

Table 2 presents an analysis summary for the samples collected from Pit B on 14 November 1995. The following analyses, with the representative analytical methods, were used on one or more samples (USEPA test methods given in parenthesis):

- metals, total and TCLP (Method 6010);
- SVOC, total and TCLP (Method 8270);
- VOC, total and TCLP (Method 8260);
- reactive cyanide (Method 7.3.3.2);

- reactive sulfide (Method 7.3.4.1);
- waste Profile - corrosivity (Method 150.1); and
- waste profile - ignitability (Method 1010).

3. INVESTIGATION AND TESTING RESULTS

3.1 East Dike Area

3.1.1 Test Pit Observations

The following observations were made during the excavation of each test pit:

- overburden thickness;
- depth to bottom of waste;
- depth to ground water;
- description of soil beneath the waste;
- depth to bottom of test pit;
- waste composition (relative percentages of glass, metal, decomposed MSW and soil mixture, rubber crumb and soil mixture, rubber crumb, thick rubbery sludge and other wastes were estimated); and
- general nature of the waste (soft, hard, etc.).

In general, based on visual observations made during the test pit excavations, the waste contains varying amounts of the materials listed below (approximated maximum percentages for any one stratum in any one test pit are also listed):

- broken and unbroken glass bottles: up to 20 percent;
- metal: up to 20 percent;
- wood and tree limbs: up to 25 percent;

- bricks: up to 10 percent;
- decomposed MSW and soil mixture: up to 80 percent;
- rubber crumb and soil mixture: up to 100 percent;
- rubber crumb: up to 100 percent; and
- thick rubbery sludge: up to 100 percent.

In addition, a 15-ft (4.6-m) long, 1-ft (0.3-m) diameter telephone pole was excavated from test pit G-TP15 from a depth of approximately 3.0 to 4.0 ft (0.9 to 1.2 m) below the ground surface. The waste type observed at this depth was rubber crumb.

The excavated materials for the three northern-most tests pits, G-TP-14 through G-TP-16, included the following wastes (from ground surface downward):

- approximately 0.5 to 1.0 ft (0.15 to 0.3 m) of cover soil;
- approximately 1.0 ft (0.3 m) of rubber crumb and soil mixture;
- approximately 3.0 to 5.0 ft (0.9 to 1.5 m) of rubber crumb; and
- approximately 1.5 to 2.5 ft (0.5 to 0.7 m) of MSW and soil mixture.

The waste in the four remaining test pits, G-TP17 through G-TP20, contained approximately 3.0 to 7.0 ft (0.9 to 2.1 m) of rubber crumb. No MSW was observed in these test pits.

Based on the observation of materials removed from the test pits, the rubber crumb in test pits G-TP17 through G-TP19 was often present as a relatively hard mass that was more difficult to excavate than a typical uncemented soil material. In attempting to excavate this material, the backhoe tended to remove sheet- or block-like pieces of the waste by tearing it from the hard waste mass. In addition, the tearing action of the

waste could be heard while the waste was being excavated. The rubber crumb in test pit G-TP20 was not as hard as the rubber crumb in test pits G-TP17 through G-TP19.

The observations for each test pit together with sample descriptions and photographs of the excavated waste are included in Appendix A of this document.

3.1.2 Field Tests

Table 3 summarizes the results of the waste characterization analyses performed on the nine bulk samples collected from the test pits. The characterized waste samples contained varying amounts of the waste types listed below (maximum weight percentages for any one sample are also listed):

- broken glass: up to 16 percent;
- metal: up to 5 percent;
- decomposed MSW and soil mixture: up to 80 percent;
- rubber crumb: up to 100 percent;
- thick rubbery sludge: up to 100 percent;
- wood: up to 8 percent;
- brick: up to 17 percent;
- stones: up to 11 percent; and
- sea shells: up to 11 percent.

The above field test results are based on sorting each fraction of the waste sample and therefore are slightly different to the results reported by visual observation.

Figures 2 and 3 present waste composition summary charts for each test pit sample. The data in Table 3 were used to prepare these charts.

3.1.3 Laboratory Tests

The data report for the laboratory tests for the waste and soil samples is included as Appendix B of this document. As shown in Table 1 of Appendix B, the waste samples have the following characteristics:

- moisture content (ASTM D 2216): 27.2 to 110.2 percent with an average of 64.3 percent;
- percent passing No. 4 U.S. standard sieve size (modified ASTM D 422): 17.8 to 75.0 percent with an average of 48.9 percent; and
- loss on ignition (ASTM D 2947): 3.2 to 89.3 percent with an average of 45.3 percent.

The results of the testing of soil samples obtained from the bottoms of the test pit excavations are presented as Table 2 of Appendix B. The soil samples had the following characteristics:

- percent passing No. 200 U.S. standard sieve size: 95.4 to 96.0 percent with an average of 95.7 percent;
- Atterberg limits (ASTM D 4318): liquid limit—50 to 67 percent with an average of 58.5 percent; plastic limit—16 to 19 percent with an average of 17.5 percent; plasticity index—34 to 48 percent with an average of 41.0 percent;
- soil classification (ASTM D 2487): lean clay (sample G-TP14-S-1) and fat clay (sample G-TP15-S-1); and

- hydraulic conductivity (ASTM D 5084): 1.8×10^{-8} to 6.5×10^{-9} cm/s with a geometric mean value of 1.1×10^{-8} cm/s.

3.2 **Pit B**

Tables 4 and 5 present the results of analyses performed on the waste samples collected from Pit B. Only compounds detected above the laboratory detection limit in at least one sample are presented in Table 4. Table 5 presents the maximum value, minimum value, and average concentrations for those compounds presented in Table 4, together with applicable regulatory limits. Copies of the laboratory data sheets for the Pit B analytical results are included as Appendix C of this document.

4. INTERPRETATION OF RESULTS

4.1 East Dike Area

4.1.1 Summary of Results

As shown on Figure 4, the total waste composition by weight for the samples that were characterized is as follows:

- 43 percent rubber crumb;
- 31 percent decomposed MSW and soil mixture;
- 12 percent thick rubbery sludge;
- 7 percent glass (broken bottles);
- 2 percent metal; and
- 5 percent brick, wood, stones, and sea shells.

Based on the visual observations of the excavated waste (presented in Section 3 of this document), the waste has a higher quantity of metal, wood, and glass than indicated by the waste sample characterization results given above. This difference is attributed to the limitations of sorting a sample that is relatively small when compared to: (i) the quantity of material excavated from the test pit; and (ii) the sizes of the pieces of waste that were excavated from the pits but, due to their sizes, not included in the sampling and sorting exercise. For example, several test pits had pieces of wood that were larger than the 5 gallon (18.5-l) sample containers. A piece of wood this size would not be included in the waste characterization sample, but was considered when relative quantity estimates of the waste composition were made based on visual observations. Therefore, the waste sample characterization results are more applicable for describing the portion of the excavated waste that generally has a particle size less than 2 in. (50 mm) in its greatest dimension.

Charts showing the percentages of the particle sizes for the rubber crumb, decomposed MSW and soil mixture, and thick rubbery sludge are included in Figures 5 through 7 of this document. As shown on the charts:

- significant portions of the rubber crumb were greater than 1 in. (25 mm) (49 percent) and less than 0.25 in. (6.4 mm) (39 percent);
- similarly, portions of the decomposed MSW and soil mixture were greater than 1 in. (25 mm) (32 percent) and less than 0.25 in. (6.4 mm) (37 percent); and
- in contrast, a majority of the thick rubbery sludge was less than 0.25 in. (6.4 mm) (92 percent).

The results of the supplemental site investigation for the East Dike Area indicate that a variety of municipal and industrial wastes were co-disposed in the northern portion of the area investigated. As shown on Figure 1, approximately 250 linear ft (76 m) of the northern portion of the East Dike Area contains co-disposed waste.

The observations made during the excavation activities also indicate that the rubber crumb may be present in the middle portions (approximately 350 linear ft (107 m)) of the East Dike Area as a relatively hard waste mass (see Figure 1). In a previous report by HLA [HLA, 1991c], the waste in the middle to northern portions of the East Dike Area was described as "*black cindery waste: dry, soft; some municipal waste; soft, with gravel size rubbery waste*". However, based on observations made during the supplemental site investigation, the waste previously described as "cindery" appears to be rubber crumb in a hard and friable state. The southern portion of the investigated area (210 linear ft (64 m)) contains rubber crumb that is not as hard as the middle portion of the East Dike Area (see Figure 1).